



DYNAMIC POSITIONING CONFERENCE
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DP Design and Control Systems - 2

Specifying DP Control Systems and Appraising Suppliers' Bids

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Introduction

Those inexperienced in specifying DP control systems may find the task daunting; requiring them to become familiar with a complex closed loop control system. Even those experienced may miss key details that result in costly extras later.

The DP control system suppliers are often faced with an incomplete specification and definition of requirements that are often subject to a wide interpretation. From this the DP control system project managers and designers are therefore presented with what the salesman thinks the client wants. Often the client only realizes that he hasn't got what he wanted until sea trials when modifications are expensive and can cause major project delays and lost revenue.

Even when the bids for the DP control system are received it can be difficult to evaluate them and ensure that all bids are given fair consideration and the best decision is made. Then care has to be taken that even if the best bid is taken that there are not major hidden costs later for contract extras and service.

The aim of this paper is to provide the reader with the necessary background in what to include in a DP specification and the process of bid appraisal. It will provide a practical and systematic approach to this problem. In addition it should help the purchaser, the DP suppliers and the DP designers in ensuring that all aspects are covered and the project can proceed on the right basis.

DP Specification Overview

The specification of the DP control system covers the following broad headings, more details are given in the referenced table later in the paper.

- **Vessel information** (use table 1)– provide sufficient back ground information on the vessel size, application, and number of vessels being built or converted, class society, DP class etc. Also include those details that are available on the propulsion and the power system.
- **DP modes required** (use table 2a) – define the key operational modes that the vessel needs to complete its mission.
- **Optional DP modes** (use table 2b) – define the operational modes that one might purchase given a suitable dayrate economy and an allowable budget. Include modes that the vessel may need for a later application; it is advisable to get an indication of the cost at this stage, thereby avoiding paying a premium later.
- **DP features** – (use tables 3a and 3b) - define the key features (software and hardware) required that the vessel needs to complete its mission. Upon submittal of the bid by the various vendors, there is also the opportunity here to consider the maturity of both the hardware and software utilized. Networks are mentioned here, as the system will likely use them, information on the network(s) used is requested in table 12.
- **Optional DP features** (use table 4) – define the features that you might purchase given a suitable day rate economy and an allowable budget. Include features that the vessel may

need for a later application; it is advisable to get an indication of the cost at this stage, thereby avoiding paying a premium later.

- **Position References** (use table 5) – define the position references required for the vessel to complete its mission. These may either require the DP supplier to provide a full system or an interface to owner supplied, shipyard supplied or existing equipment. Also define the number of spare interfaces/channels that are to be provided at this stage. This should allow the system to be expanded readily without excessive additional costs.
- **Sensors** (use table 6) – define the sensors required for the vessel to complete its mission. These may either require the DP supplier to provide a full system or just an interface for owner supplied, shipyard supplied or existing equipment. Also define the number of spare interfaces/channels that are to be provided at this stage. This should allow the system to be expanded readily without excessive additional costs.
- **Optional Position References** (use table 7) - define the position references that one might purchase given a suitable day rate economy and an allowable budget. Include position references that the vessel may need for a later application; it is advisable to get an indication of the cost at this stage, thereby avoiding paying a premium later. Include equipment that a separate price is needed for say deciding whether the owner, yard or the DP supplier should provide.
- **Optional Sensors** – (use table 8) - define optional sensors one might purchase given a suitable day rate economy and an allowable budget. Include modes that the vessel may need for a later application but it is advisable to get an indication of the cost at this stage, thereby avoiding paying a premium later. Include equipment that a separate price is needed for; in case you are trying to decide whether the owner, yard or the DP supplier should provide these.
- **Options Spares, Service and FMEA** (use table 9)– define the spares required, consumable spares are for the commissioning and the first year or so of operation. These include fuses, lamps, printer cartridges etc. Vessel spares are a more comprehensive set of spares that can be held on the vessel generally to a level of the technical capability of the personnel on board. If the owner has a number of vessels, then a set of spares may be kept at the office for shipping out to the vessel with problems, possible with a service engineer or in- company specialist. One may also consider having a supplier’s engineer on standby for the first few weeks of operation. Any of these spares packages may be considered as buying ‘insurance’, it depends on how much ‘coverage’ you need and the consequences of not having enough coverage.

Any special tools required for the installation or for fault finding or service should be quoted as an option.

Request the cost of service and design/software engineers at this time to avoid unexpected costs later. Of particular importance is the number of man-days included in the proposal for engineering, installation, start-up, tuning, and commissioning. The rate for days worked in excess of those quoted due to delays beyond the control of the vendor should be firmly established. Some means of officially reporting any such delays by the vendor to the owner at the time of occurrence should be established early on. This will help the settling of accounts at the end of the project.

Include here if the DP control supplier is to quote for providing the full FMEA of the vessel's total DP system as required by class. They will normally provide the FMEA for the DP control system but on occasions owners/shipyards like to get a price for this option.

- **Services included** (use table 10) include here all the services and documentation that needs to be included to ensure a successfully well run project that results in a fully commissioned, class approved and operational DP control system. The ESCROW account is optional if you are interested in assuring that they have access to the software source code should the DP control system supplier go out of business.
- **Terms and conditions** (use table 11) define here what is required in the way of terms of payment, delivery, price basis, warranty, whose terms and conditions are to apply, etc. Some of these can be left for the supplier to propose.
- **Supporting documentation** (use table 12) list here all the information that the supplier is required to supply as part of the proposal, to support the proposal and assist in the bid evaluation process. You may consider requiring documentation be delivered in both hardcopy and digital formats.

Some questions which should have considerable weight in the selection process are; utilization of off-the-shelf technology versus proprietary hardware, is the hardware industrial/marine rated, has the hardware been subjected to the obligatory heat and vibration environmental testing regime and has the software been developed under a QA/QC system such as Capability Maturity Model (CMM), ISO-9000, SPICE, Trillium, TickIT. and Bootstrap, etc?

DP systems often use networks as part of their architecture. Considerable information should be requested and supplied.

DP Bid Appraisal Overview

There are three established/existing suppliers of DP control systems Nautronix in the USA, Kongsberg Simrad in Norway, and Alstom in the UK. There are others now entering the DP market; these are FL Beier or Autonav, EMI and Siemens. Rolls Royce is also starting to develop a system.

Once the bids are in then the first round of bid appraisal can begin. This requires the appraiser to run through the tables 1 to 12 to ensure that each potential supplier has met the specification; and agrees with the various terms and conditions; and has provided the information required. These can be done on a line-by-line basis and questions and clarifications sort from each supplier and the process repeated.

The more difficult decision then is how to objectively weigh each of the factors you are considering while at the same time not losing sight of those items that are of particular importance to you. By repeatedly going through the tables, item by item, those main items can be highlighted, as can the strengths and weaknesses of each supplier and their proposal. Broadly, these will split into technical and commercial and it is generally sensible to short list on the basis of technical issues then finalize the decision on the basis of commercial prudence. Bearing in

mind though, there may be some obvious commercial reasons for discounting a supplier early in the appraisal process e.g. an unacceptable delivery time.

The specification tables can be used directly as the basis for the technical and commercial review broadly split as follows:-

- Technical – Tables 1 through 8
- Commercial – Tables 9 through 12

If required a spreadsheet can be made with each table's items as a basis and each supplier given a column, then compliance or non-compliance can be annotated in each cell, comments added.

Each cell in this spread sheet is then weighted on the basis of how important that factor it is to you the purchaser and the relative weighting you would give each supplier for it.

While price is always an important factor so is the cost of future support and technical competence and experience will also be key. Remember this quote from John Ruskin – 1819 to 1900.

"There is nothing in the world that some man cannot make a little worse and sell a little cheaper, and he who considers price only is that man's lawful prey."

A key tip is for you or the supplier to minute the final negotiation meetings so that agreements made are recorded and can be used to resolve possible future results.

DP Specification and Bid Appraisal Tables

General Information	
<p style="text-align: center;"> Nos of vessels Future Vessels Initial Application(s) Future Application(s) Max Operating Conditions Class Society DP Class Vessel 1 Vessel 2 and above Area(s) of operation Timescales New Build or Conversion </p>	

Propulsion	Nos	Rating	Control	Control	Drive	Manu	I/Face
Bow Thrusters							
Stern Thrusters							
Main Propellers							
Rudders							
Power System							
Generators							
Bus Ties							

TABLE 1

DP MODES (INCLUDED)	NOTES
Manual Hdg - Manual Position Auto Hdg - Manual Position Auto Hdg - Auto Position Manual Control Individual Axes Autopilot ROV Follow Track Follow Slow Speed Track Follow Fast Speed Internal Simulation	

TABLE 2a

DP MODES (OPTION)	NOTES
Hold Area Mode Position Control by Maneuvering Bow Only mode Optimum Heading	

TABLE 2b

DP FEATURES Software (INCLUDED)	NOTES
Noise Rejection Logic Pos Ref and Sensor Blending Power Limiting Port, Stbd, or Both Props Ahead Wind Compensation Dead Reckoning Centers of Rotation fixed Centers of Rotation Variable Fast Heading Update Consequence Analysis Capability Plot Voting on inputs Voting on thruster outputs Operator Set Alarm Levels Gain Selection Joystick Sensitivity Selection Display pages Display pages	Class 2 or 3 – selectable When 3 pos refs or sensors selected Summary, sensor, thruster, power mimic, power trend Alarm, I/O, plot, position (graphical & numeric)

TABLE 3a

DP FEATURES Hardware (INCLUDED)	NOTES
Digital Processors 20" Flat Screen Push-button Operation GUI Operation Console Facing Alarm and Event Printer Isolated input and output signals Dual Redundant Network Redundant SPUs Anti condensation heaters 30 minute UPS(s)	Pos refs, sensors, function, display, mode, thrusters Battery type

TABLE 3b

DP FEATURES (Optional)	NOTES
Axes Priority Select Touch Screen Trainer Simulator Screen Copy Printer DP Alert System Remote Diagnostics	

TABLE 4

POSITION REFERENCES	NOS	NOTES
INTERFACES OR FIT	NOS	NOTES
Laser Ranging Acoustics DGPS Taut Wire Artemis Additional Interfaces		Configurable by DP operator

TABLE 5

SENSORS INTERFACE OR SUPPLY	NOS	NOTES
Gyros VRS Wind Sensors		

TABLE 6

POSITION REFERENCES	NOS	NOTES
OPTIONS	NOS	NOTES
Gate Valve and Spool Piece Artemis Artemis Explosion Proof Artemis Short Range		

TABLE 7

SENSORS OPTIONS	NOS	NOTES
Gyros Wind Sensors Wind Speed Indicator Wind Direction Indicator		

TABLE 8

OPTIONS – FMEA, SPARES & SERVICE	Yes/No	NOTES
FMEA of DP system Consumable Spares Vessel Spares Depot Spares Special Tools Standby 1 week for vessel's first operation Day Rate for service engineers Day rate for design/software engineers		whole system for class

TABLE 9

SERVICES – INCLUDED	Yes/No	NOTES
Installation and Commissioning Sea Trials Kick Off Meeting at Owners Technical Meeting at Shipyard Project Manager for duration of projects Project Engineer for duration of project Project Plan Monthly Progress Reporting Project or Functional Design Specification FMEA of DP control system Design Review FAT Quality plan to ISO 9000 Operator Training Maintenance Training Classification Society Submittals Installation Manual System Drawings Interconnection Drawings Provisional Operations Manual - at FAT Final Operations Manual 30 days after sea trials ESCROW account for software		Expenses included Owner to review To be submitted to Owner Owner to approve Owner to review Owner to attend main review Owner to attend FAT

TABLE 10

TERMS AND CONDITIONS	Yes/No	NOTES
Terms of payment Delivery – subsequent vessels Price and price basis – each vessel Currency Inclusive of any customs & import taxes Warranty Contract Conditions Validity		

TABLE 11

SUPPORTING DOCUMENTATION REQUIRED WITH FULL PROPOSAL	Yes/No	NOTES
Experience List Testimonials and References Details of Noise rejection and sensor blending Number of DP Systems this type of vessel Number of DP systems supplied to this Class of DP Number of DP systems supplied to this Class Society Description of service facilities – vessel operational area Description of service facilities - World Wide Operating System Used Positioning Accuracy Statement Information on DP Hardware Information on DP Hardware Information on DP Hardware Information on DP Hardware and Software Network Topography Network Criteria of Acceptability Network on line monitoring scheme Network of line diagnostic tools Network cable(s) specification Network inspection and testing requirements Agreed minutes of final negotiation meeting(s)		Commercial or Proprietary? Type Tested? Environmental Specification QA/QC system in place

TABLE 12